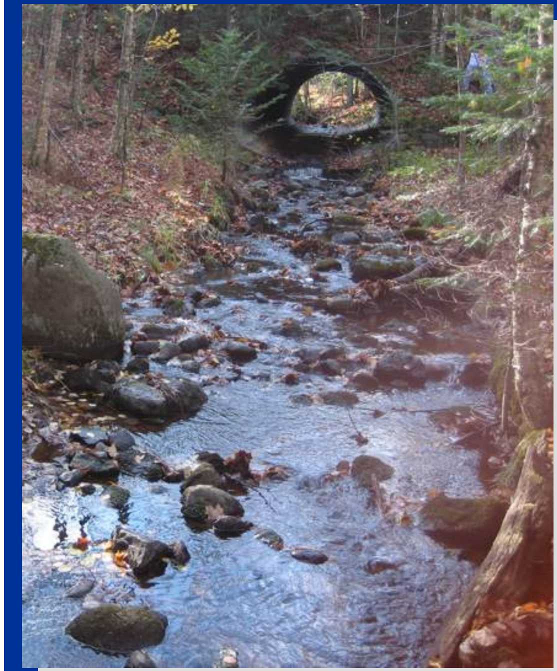
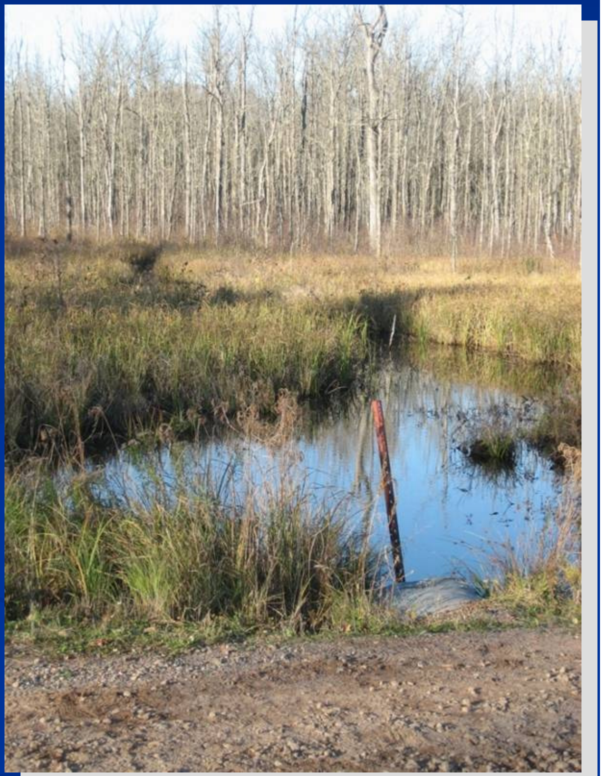
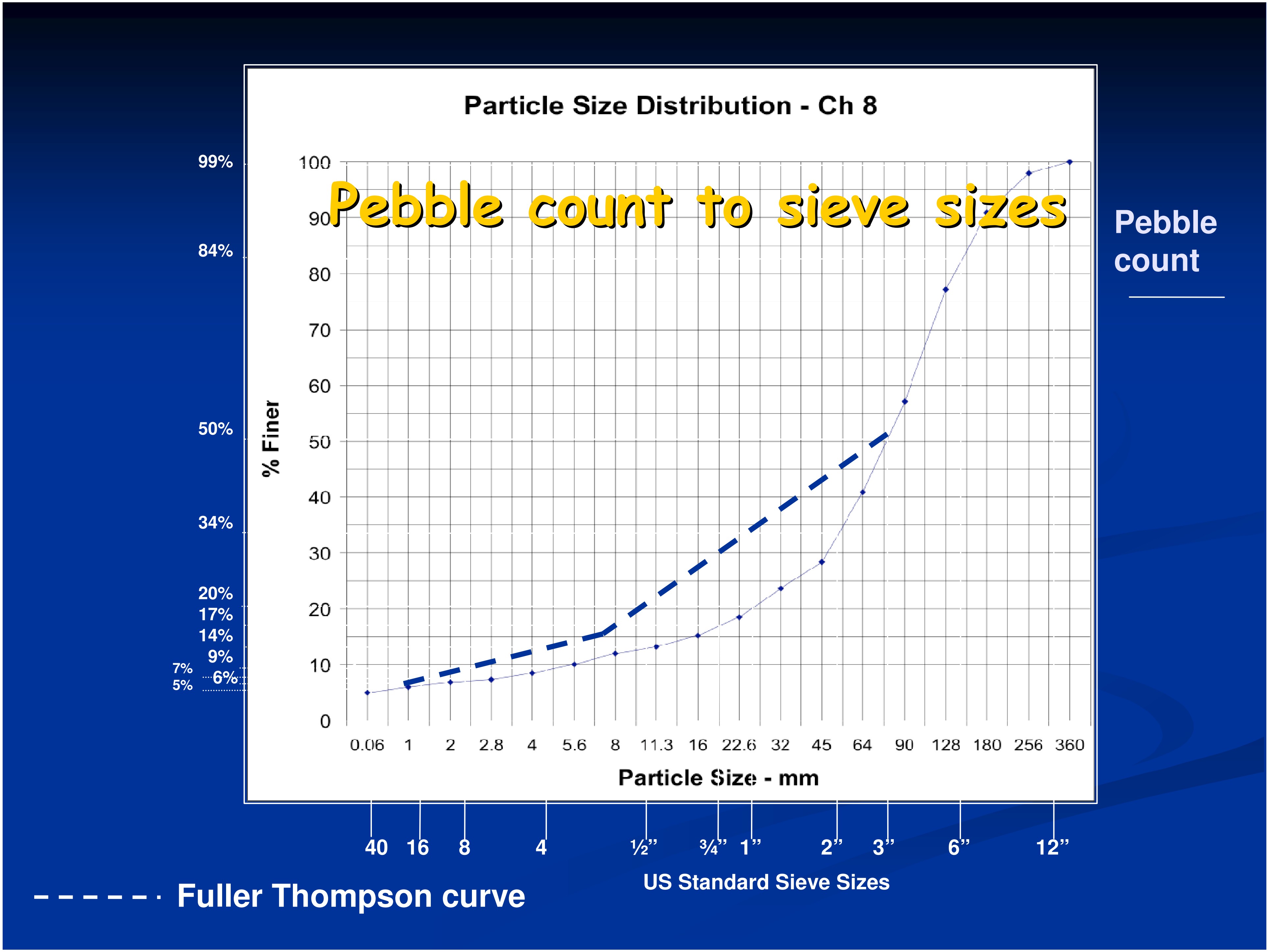
Describing Stream Simulation Bed Details, Sediment and Pollution Controls







Pebble count to sieve sizes
Particle Size Distribution - Ch 8
% Finer
100
90
80
70
60
50
40
30
20
10
0
0.06 1 2 2.8 4 5.6 8 11.3 16 22.6 32 45 64 90 128 180 256 360
Particle Size - mm
99%
84%
50%
34%
20%
17%
14%
9%
7%
6%
5%
Pebble count
40 16 8 4 ½" ¾" 1" 2" 3" 6" 12"
US Standard Sieve Sizes
Fuller Thompson curve

Why learn this pebble count ?

- When importing stream simulation material, sieve conversion makes it easy to order portion of the design mix from a quarry.
  - Learn to do a pebble count of a stockpile with a hydrologist to verify mixing and delivered materials
  - Important to obtain a well graded mix.
  - Don't skip sizes
  - Measure other key pieces, don't guess;
  - medium diameter is not maximum diameter

The Fuller Thompson Equation

Fuller's maximum density curve is:

$$P=100(d/D)^n$$

where: P=Total percent passing or finer than the sieve size d
D=maximum size of aggregate
d=diameter of the sieve in question.

See Fuller, W.B. and S.E. Thompson. The Laws of Proportioning Concrete. Journal of **Transportation** Division, American Society of Civil Engineers, Vol. 59, 1907.

Fuller Thompson Equation

Choose a range that gives the same d-5 as that observed in the stream channel

n	0.45	0.5	0.55	0.6	0.65	0.7
D-50	3.00	3.00	3.00	3.00	3.00	3.00
D-16	0.24	0.31	0.38	0.45	0.52	0.59
D-5	0.02	0.03	0.05	0.06	0.09	0.11

Table 705-7- Project Gradation for Streambed Simulation Rock,

Values are "percent finer" than sieve size

Standard Sieve (inches)	Pebble Count: Surface "armor" stability	Full-Thomson adjustment For sub surface permeability	Filler Material For voids during construction
12" (d-max)	90-100	90-100	
6" (d-84)	79-89	79-89	
3" (d-50)	45-55	45-55	
3/4" (d-16)	12-22	25-30	100%*
#40 (d-5)	5-10	5-10	Min 50%

Fill in % Finer Values allowing +/- 5% from the distribution curve:

* d-16 from Pebble Count or 1 inch, whichever is smaller.

648 Stream Simulation Material Placement

Begin construction from the downstream end working upstream.

<u>Changes to construction flow will be allowed </u>making allowances for<u> on a case by case basis due to</u> poor stream to culvert alignment, traffic requirements, limited access, and preservation of existing trees reinforcing the banks.

Deviation from construction flow (downstream to upstream) must be requested in writing and approved by the CO<u> or their designee,</u> 5 days in advance of construction.

648 Stream Simulation Material Placement continued

Place stream simulation rock in one or more layers with a layer depth less than 1 ½ times the maximum dimension of the stream simulation rock, but no greater than 2ft.

Place stream simulation rock by methods that do not cause segregation or damage to the prepared surface.

Place or rearrange individual rocks to obtain a uniformly dense, compact, low permeability mass, matching stream simulation bed details.

Fill voids by machine or hand tamping before placing the next lift. Compact bed materials by mechanical means such as plate compactors, loaders, etc.

Stream Simulation Bed Placement

A vibratory plate compactor on an excavator or suspended from one, greatly improves rock to rock contact and consolidation of fines into voids.

Subsurface streambed sediments

648 Stream Simulation Material Placement continued…

Fill all voids left during placement of Stream Bed Simulation Rock, Fish Rest Stops (habitat rocks), weirs, banks and stream bed materials adjacent to footings, concrete structures or corrugated pipes with foundation fill.

Use water pressure, metal tamping rods, and similar hand operated equipment to force material into all surfaces and subsurface voids between the structure and rocks, and between individual rocks.

Notify the CO at least 48 hours in advance of the stream bed material installation.

Develop a Plan Ahead of Time

Preserve streambed material:

- by separating from other excavation
- excavated saturated streambed material may be difficult to place back unless dried or mixed with dry.
- encourage drainage, cover to avoid rainfall saturation

Plan on using a percentage of contract quantity 20-50%. Base on long profile…. This is SITE DEPENDENT!

Import Surface Armor – Pebble count based gradation

Additional material should be contract gradation to act as armor. Use minimum thickness of armor(2*d-84).

Have back-up plans for obtaining more. Or just spec the entire gradation

Typical Erosion, Sediment and Pollution Control Details

Standard Specifications

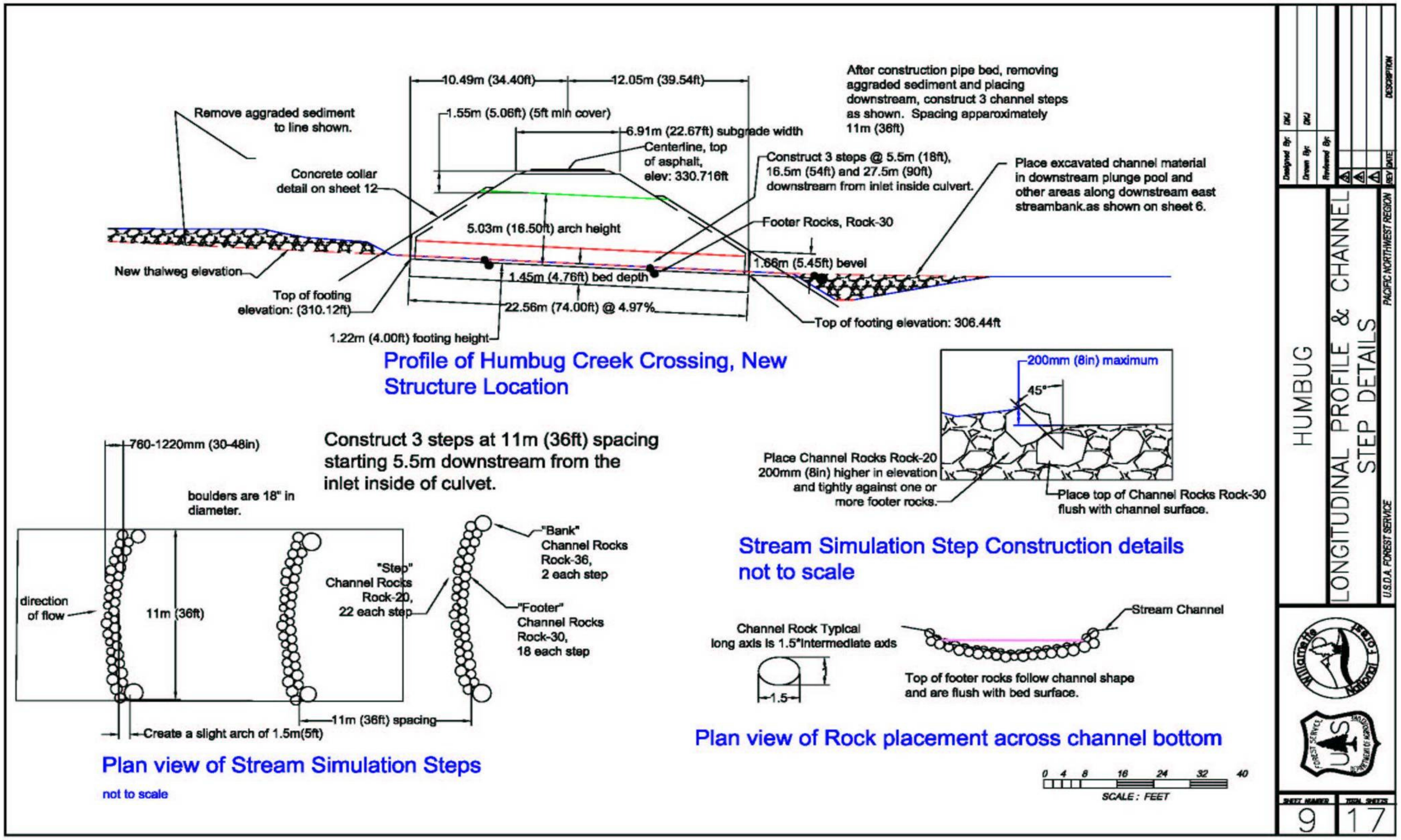
Special Project Specifications

Special Contract Requirements

Know what the project needs and choose to partially or fully design specific project details.

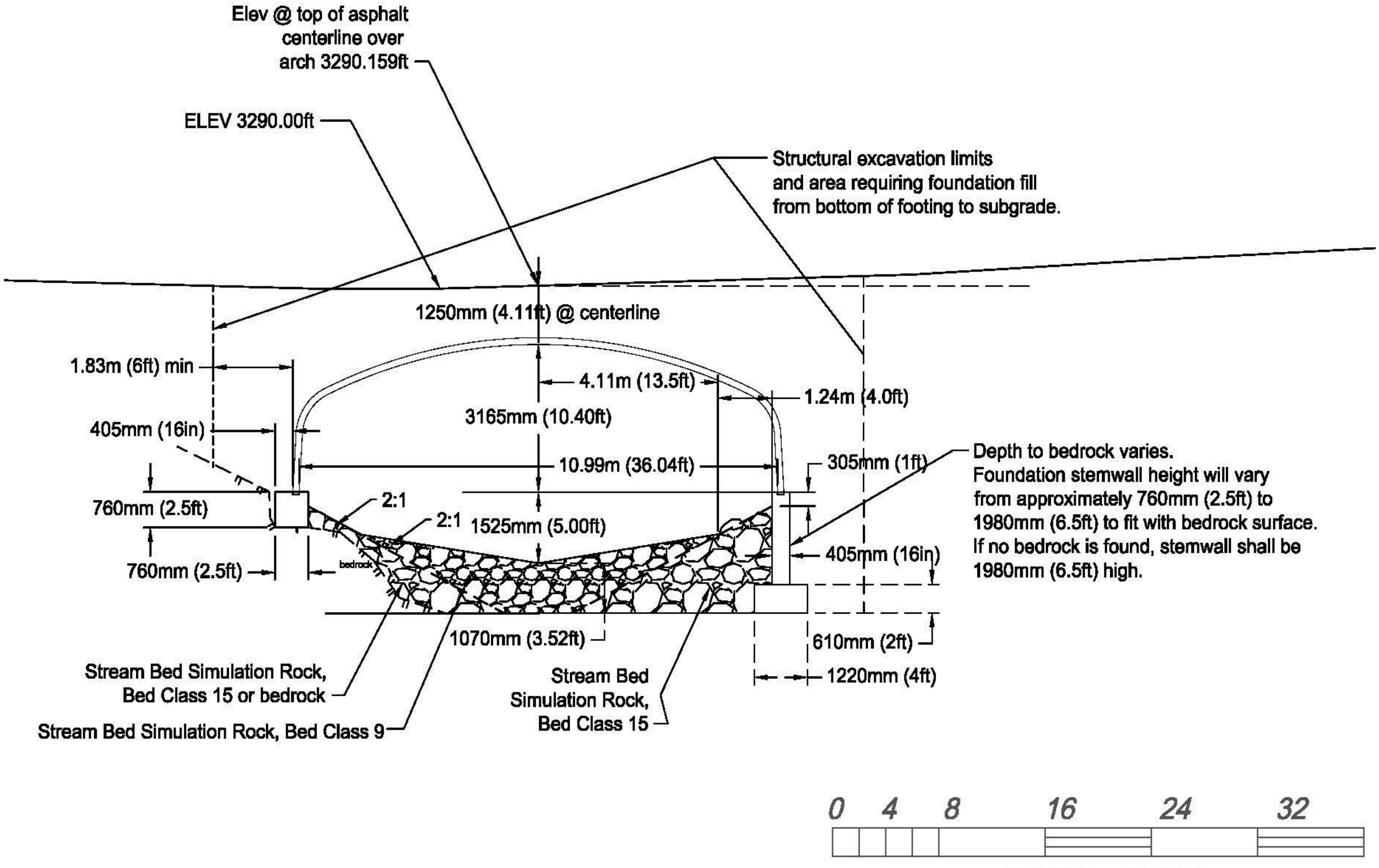
- Design critical details such as dewatering methods using drawings and specifications:
- Or critically review, modify, accept contractor plans. Require calculations for choosing diversion pipe, pumps, sump pumps, diversion ditches.

Constructible Plans and Details are Essential

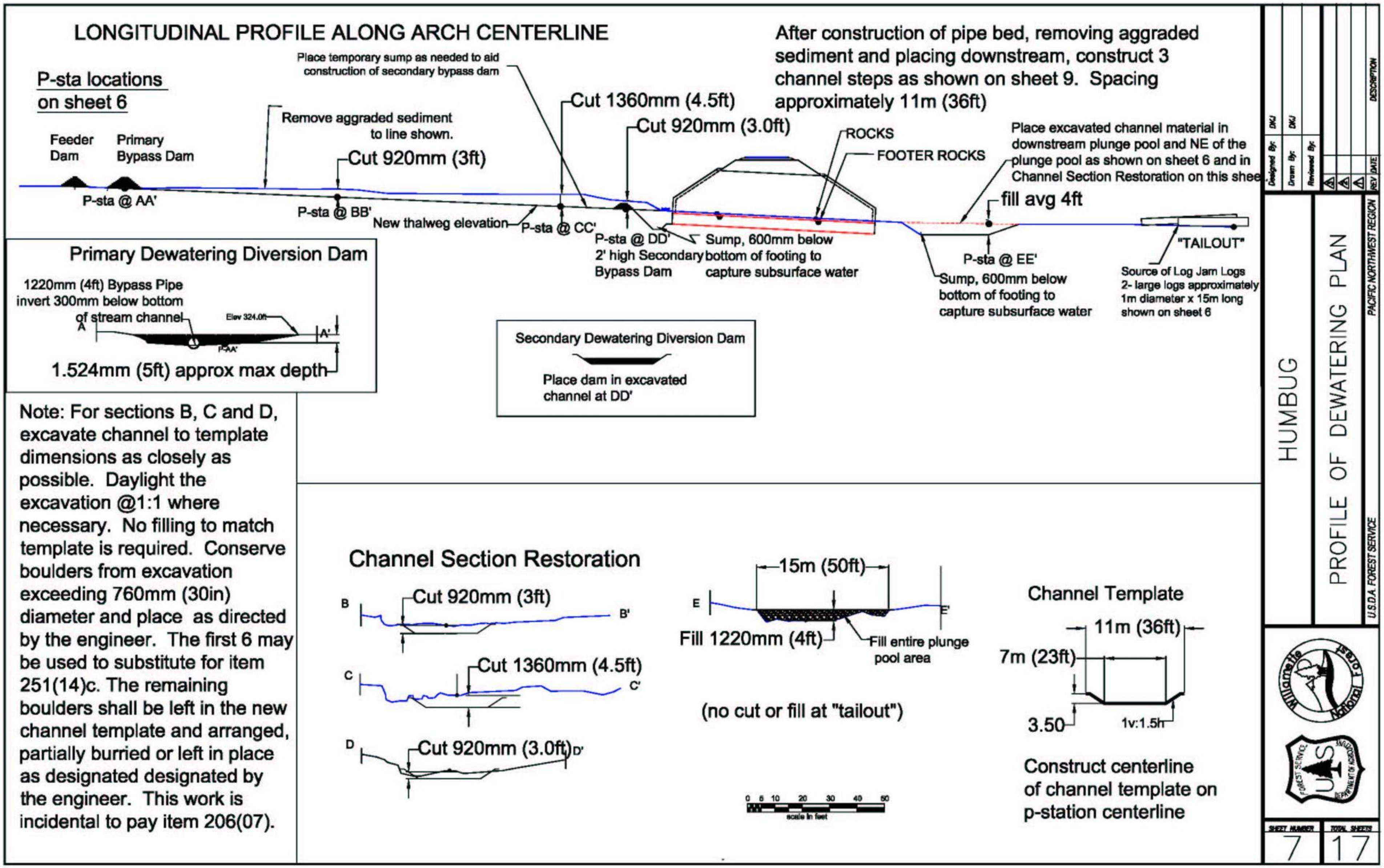


X-SECTION THROUGH CENTERLINE OF ROAD SURFACE.

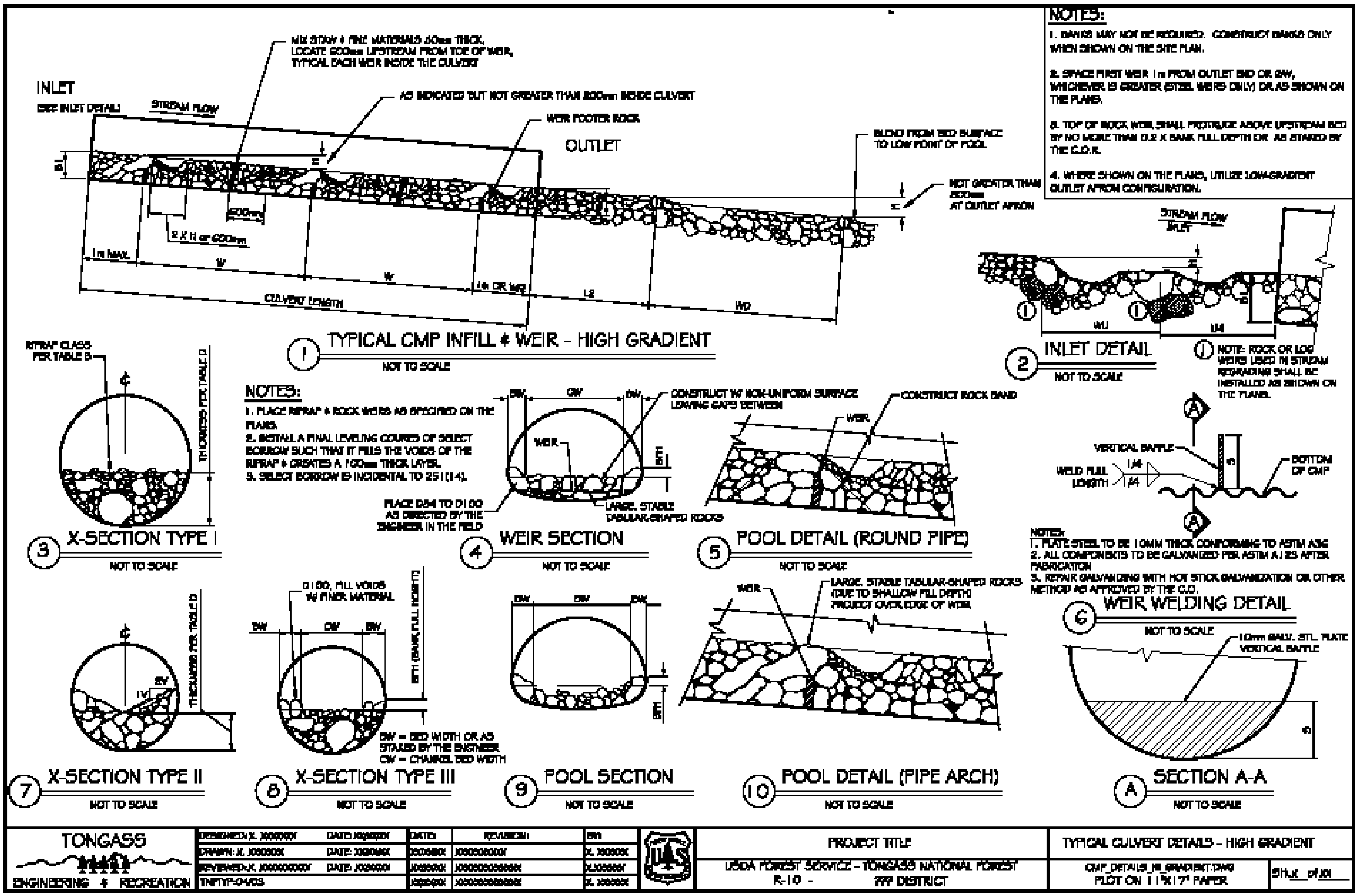
FOUNDATION ON RIGHT MAY VARY FROM HEIGHT SHOWN DUE TO BEDROCK.



Channel Design



Embedded pipe with sediment retention structure, detailed step & pool features for tabular rock design



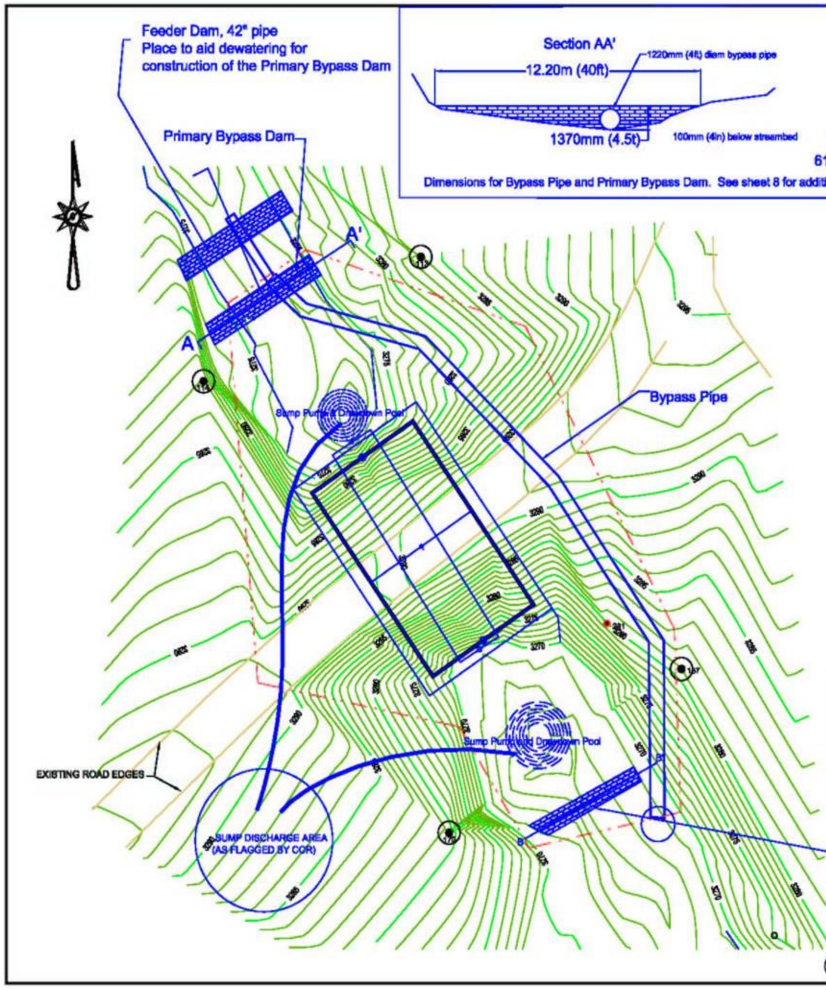
Bob Gubernick

DEWATERING

Design Considerations

Dewatering Design Elements

- Temporary sump -
  - capacity, pumps
- Diversion dam or pump
  - flow capacity, pumping method for 24hr/7days/week
- Diversion pipe or channel -
  - flow capacity at gradient
- Divert water, remove aquatic species
  - timing for FS biologist
- Sediment control sump downstream
  - fines and treatment, sump capacity
- Sediment treatment system
  - filter area and capacity



GENERAL:

Dual bypass dams may trap more flow.

Dams, bypass pipes joints, and trenches will leak a little if constructed properly;

Use upstream sump to capture seepage and if clean, put back into stream.

High capacity sump below project, traps sediment from excavation area and transport to treatment area.

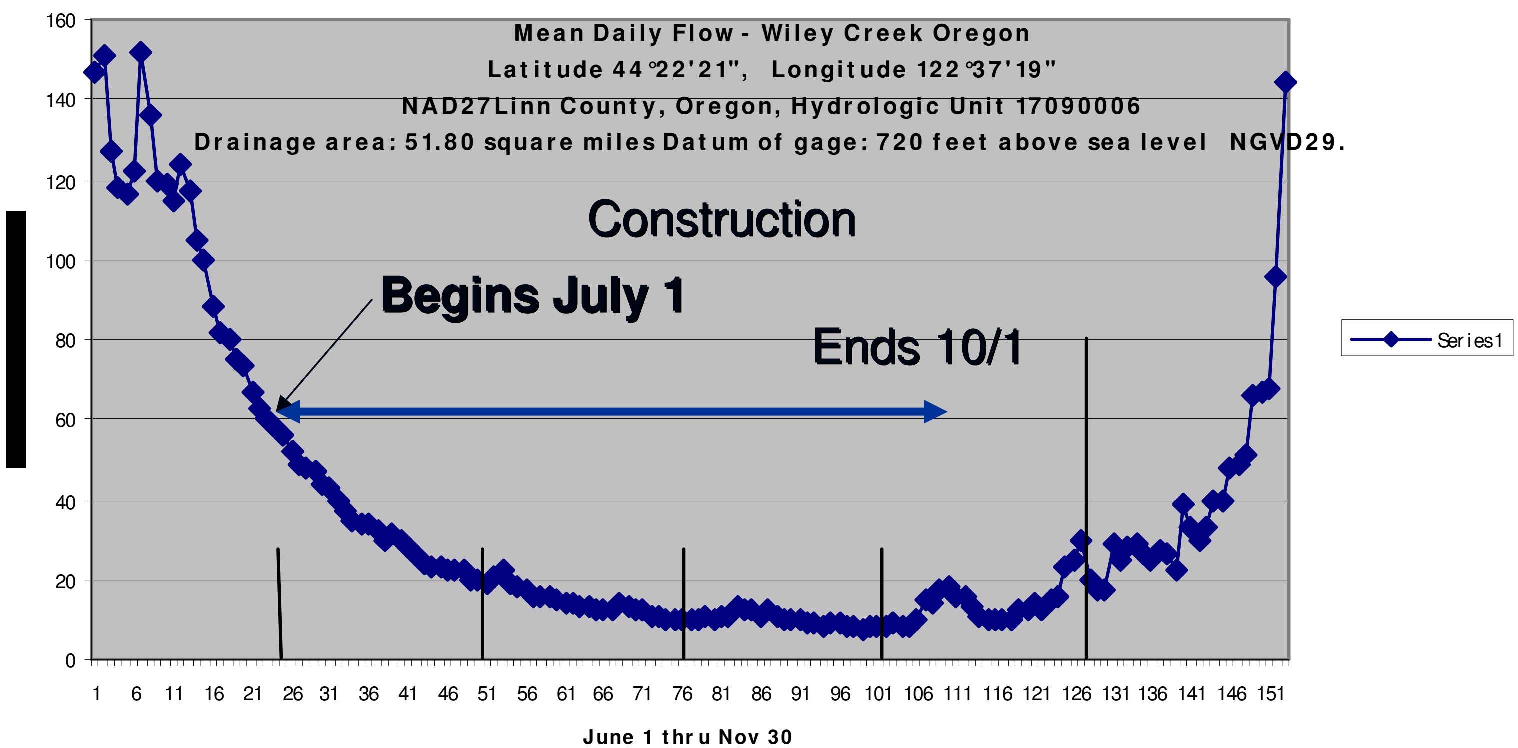
Natural sediment filtering is often possible in vegetation; may need to do more

May need a backwater prevention dam on backwatered, deep excavations.

A scour pool can frequently be used

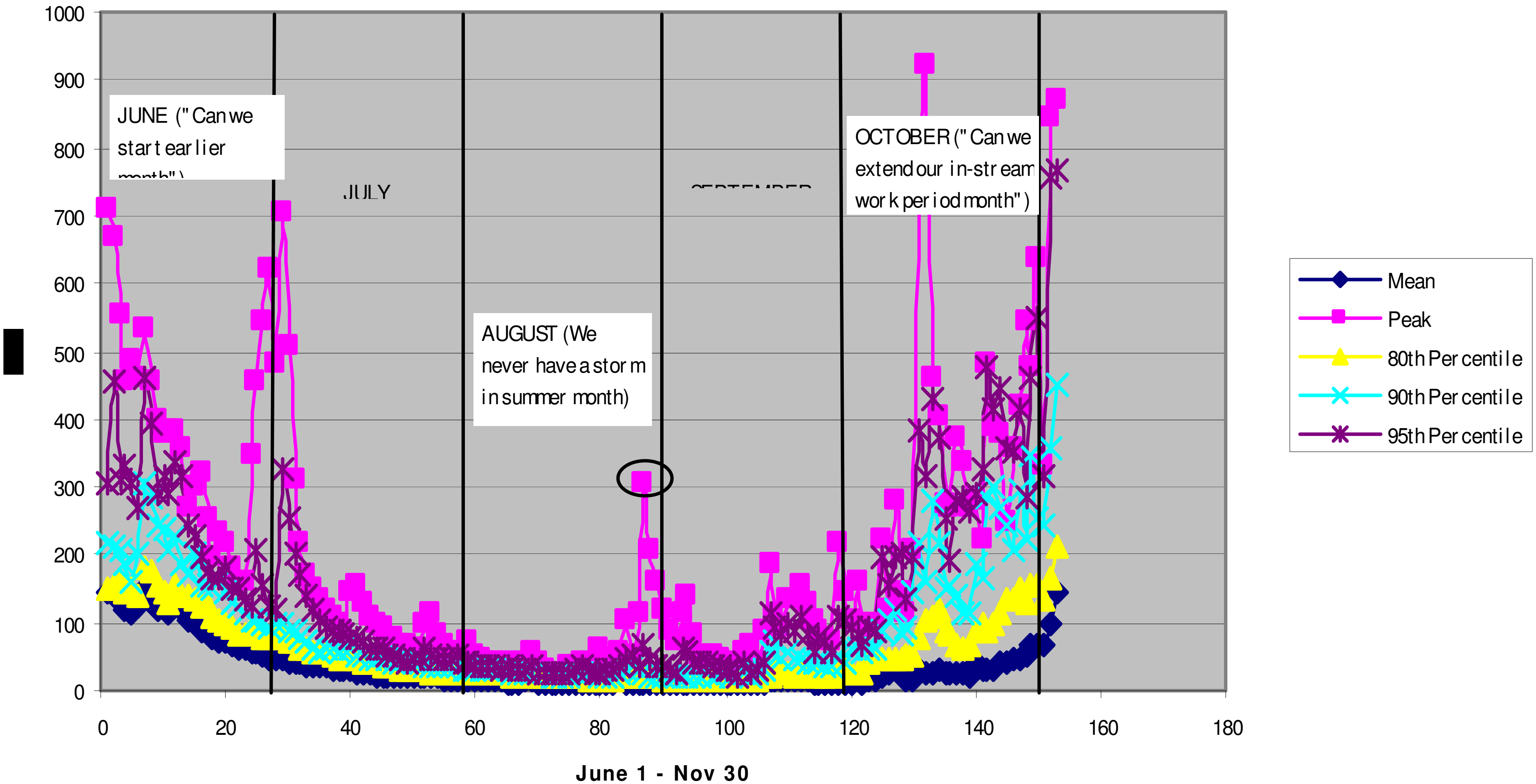
Designed Dewatering Plan when critical Just specify dam height, pump size and pipe size otherwise – Big Summer storms do happen!

Mean Daily Flows highest at start: 60cfs



What to factor in and PLAN FOR

Storm events are much higher and happen frequently at least once during construction in most areas better value ~ > 100 cfs

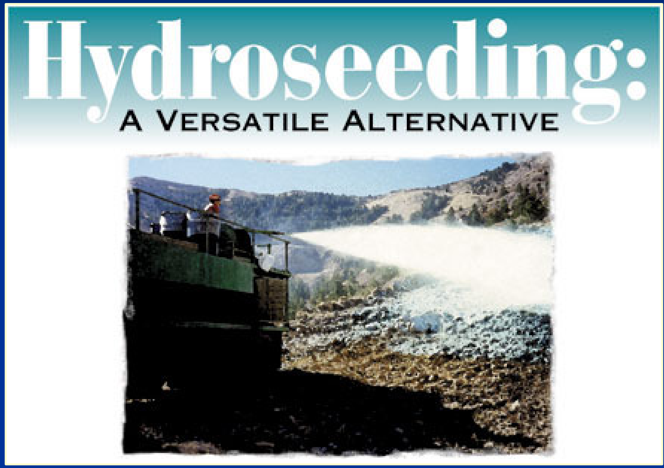


What to Know and specify

- Summer flows as determined by gage data, channel dimension indicators for less than bank full flows, historical records compared to known sites, flasher in small stream, moderated in large
- It's not just pipe capacity. It's how full, headwater supplied by diversion dam, actual gradient of bypass pipe
- Specify pipe size, location, dam height, consider contractors plan but don't compromise on hydraulic capacity for storms.
- Consider a minimum of 24" diameter in small streams. 30 – 48 in larger channels.
- Diversion Ditches can be very effective

Mandatory Feature - Downstream Sump for Collecting and Treating Sediments.

Erosion Prevention and Trapping, Pollution Control



Long term stabilization

sediment trapping measures

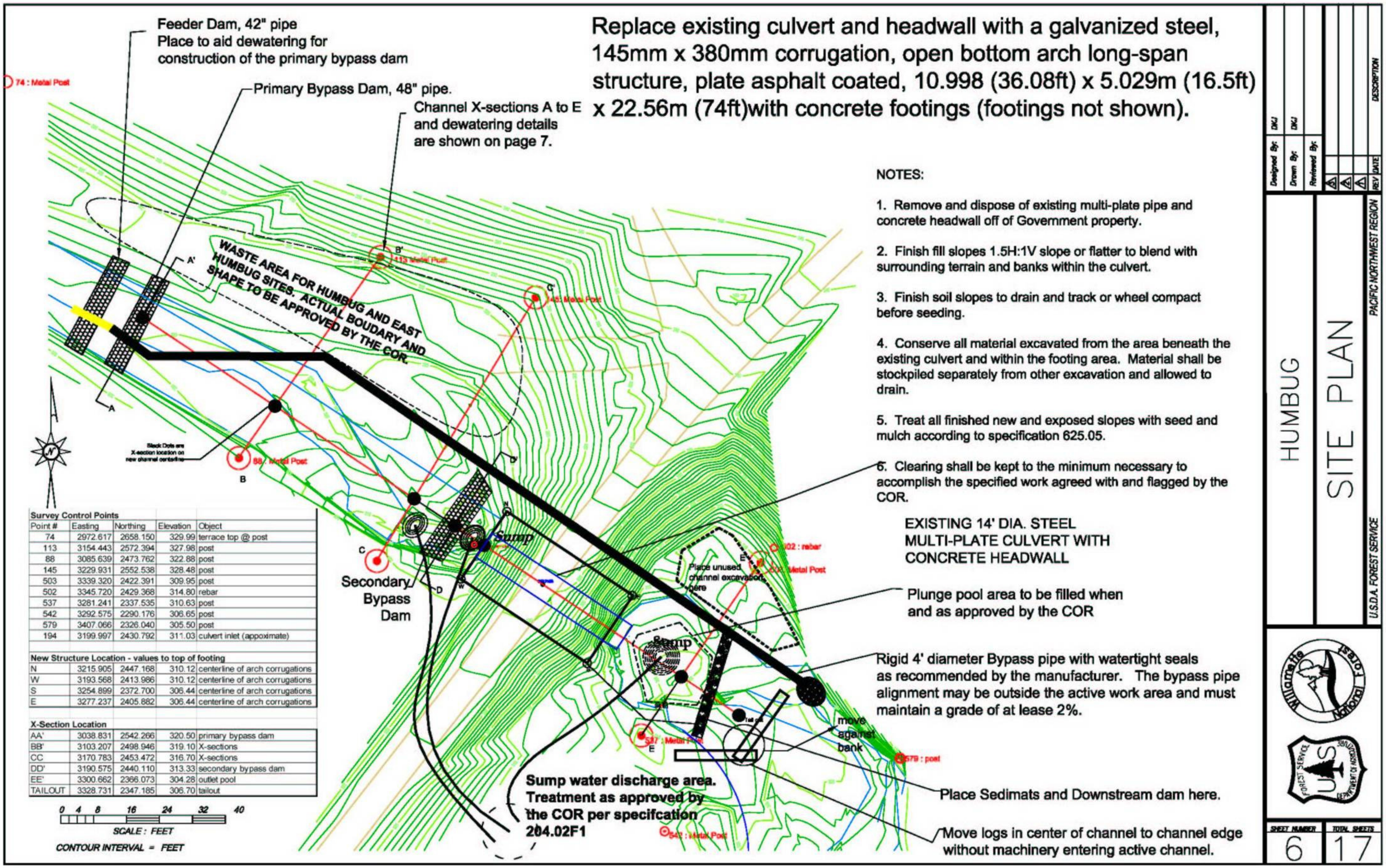
Sediment removal

Pollution containment

Erosion control

- Pollution control under pumps and fuel stations
- Erosion of disturbed ditches and slopes
- Dirt on road can create considerable turbidity during a storm
- Prevention is cheap
- Call for straw bales, silt fence and other erosion control materials in the contract.
- GOV Best Management Practices

Designed Dewatering Plan



Survey Control Points

Point #	Easting	Northing	Elevation	Object
74	2972.617	2658.150	329.99	terrace top @ post
113	3154.443	2572.394	327.98	post
88	3085.639	2473.762	322.88	post
145	3229.931	2552.538	328.48	post
503	3339.320	2422.391	309.95	post
502	3345.720	2429.368	314.80	rebar
537	3281.241	2337.535	310.63	post
542	3292.575	2290.176	306.65	post
579	3407.066	2326.040	305.50	post
194	3199.997	2430.792	311.03	culvert inlet (appoximate)

New Structure Location - values to top of footing

N	3215.905	2447.168	310.12	centerline of arch corrugations
W	3193.568	2413.986	310.12	centerline of arch corrugations
S	3254.899	2372.700	306.44	centerline of arch corrugations
E	3277.237	2405.882	306.44	centerline of arch corrugations

X-Section Location

AA'	3038.831	2542.266	320.50	primary bypass dam
BB'	3103.207	2498.946	319.10	X-sections
CC	3170.783	2453.472	316.70	X-sections
DD'	3190.575	2440.110	313.33	secondary bypass dam
EE'	3300.662	2366.073	304.28	outlet pool
TAILOUT	3328.731	2347.185	306.70	tailout